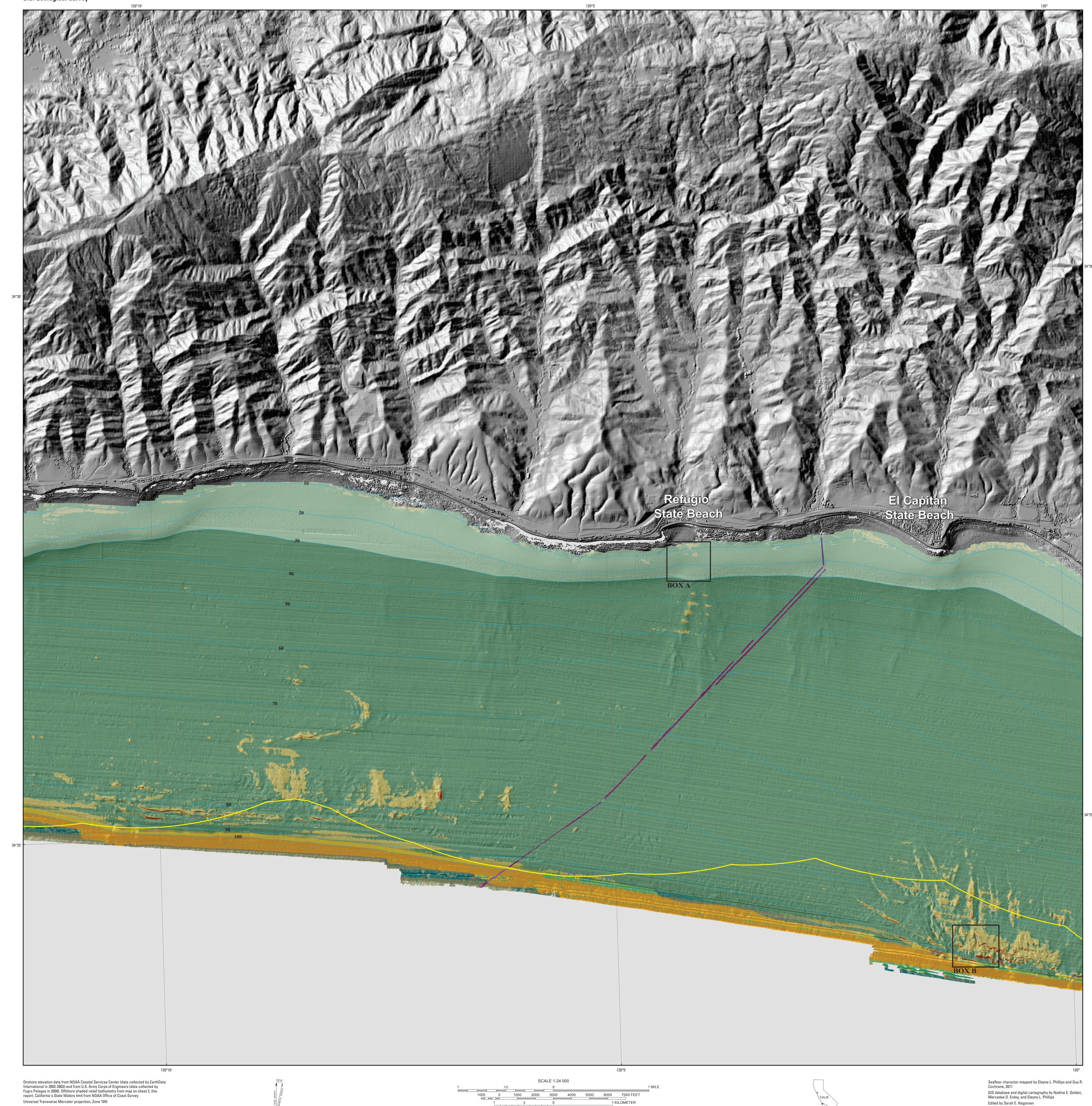
## U.S. Department of the Interior U.S. Geological Survey

**NOT INTENDED FOR NAVIGATIONAL USE** 



# **DESCRIPTION OF MAP UNITS**

**Fine- to medium-grained smooth sediment**—Low backscatter, low rugosity; typically mud to medium-grained sand; often rippled and (or) burrowed Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically coarse-grained sand, gravel, cobbles, and bedrock Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose

medium-grained sand; often rippled and (or) burrowed coarse-grained sand, gravel, cobbles, and bedrock Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose

# SLOPE CLASS 2—5 TO 30 DEGREES

medium-grained sand; often rippled and (or) burrowed coarse-grained sand, gravel, cobbles, and bedrock Rugged anthropogenic material—High backscatter, high rugosity; related to development by

# DEPTH ZONE 4—100 METERS TO 200 METERS WATER DEPTH

# medium-grained sand; often rippled and (or) burrowed Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically coarse-grained sand, gravel, cobbles, and bedrock

coarse-grained sand, gravel, cobbles, and bedrock Rugged anthropogenic material—High backscatter, high rugosity; related to development by

## **EXPLANATION OF MAP SYMBOLS**

Area of "no data"—Areas near shoreline not mapped owing to insufficient high-resolution seafloor mapping data; areas beyond 3-nautical-mile limit of California's State Waters were not mapped as part of California Seafloor Mapping Program 3-nautical-mile limit of California's State Waters

—20 — Bathymetric contour (in meters)—Derived from modified 10-m-resolution bathymetry grid. Contour interval: 10 m

# DEPTH ZONE 2—INTERTIDAL TO 30 METERS WATER DEPTH

# DEPTH ZONE 3-30 METERS TO 100 METERS WATER DEPTH

Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically

# Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose

# SLOPE CLASS 1—0 TO 5 DEGREES Fine- to medium-grained smooth sediment—Low backscatter, low rugosity; typically mud to

# Rugged anthropogenic material—High backscatter, high rugosity; related to development by SLOPE CLASS 2—5 TO 30 DEGREES

# medium-grained sand; often rippled and (or) burrowed Mixed smooth sediment and rock—Moderate to very high backscatter, low rugosity; typically

SLOPE CLASS 1—0 TO 5 DEGREES

Rugged anthropogenic material—High backscatter, high rugosity; related to development by

# SLOPE CLASS 1—0 TO 5 DEGREES

# Rugged anthropogenic material—High backscatter, high rugosity; related to development by

# **Fine- to medium-grained smooth sediment**—Low backscatter, low rugosity; typically mud to

# Rock and boulder, rugose—High backscatter, high rugosity; typically boulders and rugose

# Santa Barbara Channel

## **DISCUSSION**

This seafloor-character map of the Offshore of Refugio Beach map area in southern California was produced using video-supervised, maximum-likelihood classification of the bathymetry and backscatter (intensity of return) signals from sonar systems (a summary of the video data collected for the purpose of supervising the classification is shown on sheet 6). Rugosity (a GIS-derived characterization of roughness) and backscatter intensity were used as variants in the classification. The interpreted classifications were then draped over shaded-relief bathymetry (see sheet 2).

The substrate classes mapped in this area have been divided into the following California Marine Life Protection Act depth zones: Depth Zone 2 (intertidal to 30 m), Depth Zone 3 (30 to 100 m), and Depth Zone 4 (100 to 200 m). In addition, the following slope classes are represented on this map (Coastal and Marine Ecological Classification Standard slope zones are shown in parentheses): Slope Class 1, 0° to 5° (flat); and Slope Class 2, 5° to 30° (sloping). Depth Zone 1 (intertidal), Depth Zone 5 (greater than 200 m), and Slope Classes 3 to 5, greater than 30° (steeply sloping to overhang), and Slope Class 4, 60° to 90° (vertical) are not present in this map area. Fine- to medium-grained smooth sediment (sand and mud) makes up 91.2 percent (104.3 km²) of the map

area: 11.3 percent (12.9 km²) is in Depth Zone 2, 79.3 percent (90.7 km²) is in Depth Zone 3, and 0.6 percent (0.7 km²) is in Depth Zone 4. Mixed smooth sediment (sand and gravel) and rock (sediment typically forming a veneer over bedrock, or rock outcrops having little to no relief) make up 8.5 percent (9.7 km²) of the map area: 0.4 perecent (0.5 km²) is in Depth Zone 2, 3.9 percent (4.5 km²) is in Depth Zone 3, and 4.1 percent (4.7 km²) is in Depth Zone 4. Rock and boulder, rugose (rock outcrops and boulder fields having high surficial complexity) makes up 0.1 percent (0.2 km²) of the map area: less than 0.1 percent (<0.1 km²) is in Depth Zone 2, 0.1 percent (0.2 km²) is in Depth Zone 3, and less than 0.1 percent (<0.1 km²) is in Depth Zone 4. Rugged anthropogenic material (a pipe that traverses the entire width of California's State Waters in the map area) makes up 0.2 percent (0.2 km²) of the map area: less than 0.1 percent (<0.1 km²) is in Depth Zone 2, 0.2 percent (0.2 km<sup>2</sup>) is in Depth Zone 3, and less than 0.1 percent (<0.1 km<sup>2</sup>) is in Depth Zone 4 (table 1).

### Table 1. Coverage of classified seafloor, in square kilometers (sq km) and percent of total area, broken into California Marine Life Protection Act Depth Zones 2, 3, and 4.

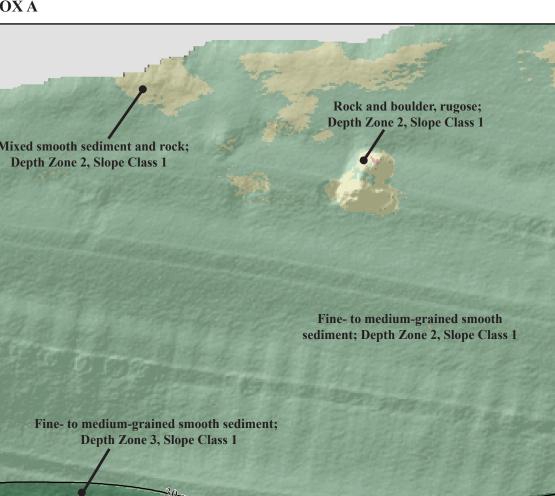
	Total		Depth Zone 2 (water depth 0–30 m)		Depth Zone 3 (water depth 30–100 m)		Depth Zone 4 (water depth 100–200 i	
	percent	sq km	percent of total	sq km	percent of total	sq km	percent of total	sq km
Fine- to medium- grained smooth sediment	91.2	104.3	11.3	12.9	79.3	90.7	0.6	0.7
Mixed smooth sediment and rock	8.5	9.7	0.4	0.5	3.9	4.5	4.1	4.7
Rock and boulder, rugose	0.1	0.2	<0.1	<0.1	0.1	0.2	<0.1	< 0.1

0.2 0.2 <0.1 <0.1 0.2 0.2 <0.1 <0.1

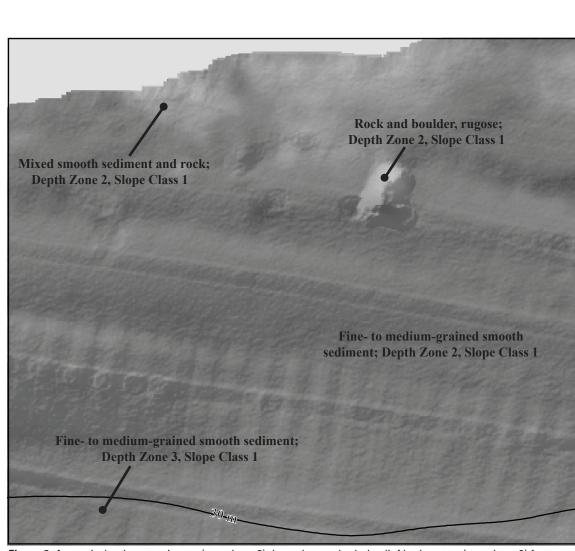




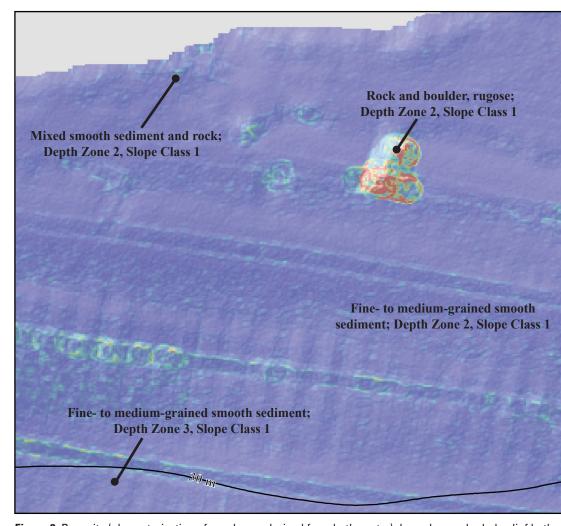




Box A, on map, for location): Depth Zone 2 (intertidal to 30 m), Depth Zone 3 (30 to 100 m), and Slope Class 1 (0°-5°). Fine- to medium-grained smooth sediment is shown in shades of green; mixed smooth sediment and rock is shown in shades of tan; and rugose rock and boulder is shown in shades of pink. Bathymetric contour (30 m) added for depth reference.



area as figure 1 (Box A on map). Brighter areas indicate coarse-grained, rough, or hard seafloor; darker areas indicate unconsolidated (loosely packed) sediment. Interpreted substrate classes from figure 1 included for comparison. Bathymetric contour (30 m) added for depth reference.



(see sheet 2) for same area as figure 1 (Box A on map). Rugosity values are displayed in muted "rainbow" color spectrum that ranges from purple (low rugosity) through green (medium rugosity) to red (high rugosity). Areas of high slope are indicated by high-rugosity values (red); areas of low slope, by medium- to low-rugosity values (green to purple); however, northwest-southeast-trending areas of high rugosity are data-collection artifacts. Interpreted

substrate classes from figure 1 included for comparison. Bathymetric contour (30 m) added for depth reference.

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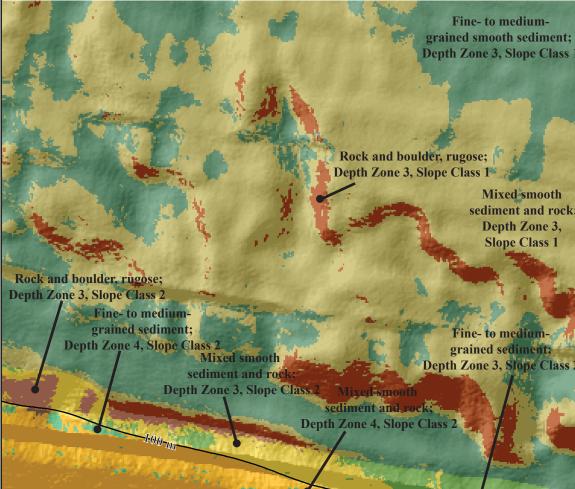
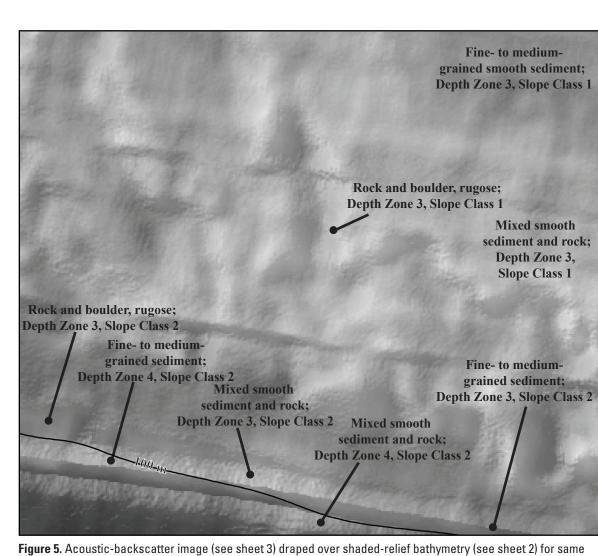


Figure 4. Detailed view of substrate classes mapped further offshore, south of El Capitan State Beach (see Box B, on map, for location): Depth Zone 3 (30 to 100 m), Depth Zone 4 (100 to 200 m), Slope Class 1 (0°-5°), and Slope Class 2 (5°-30°). Fine- to medium-grained smooth sediment is shown in shades of green; mixed smooth sediment and rock is shown in shades of tan and orange; and rugose rock and boulder is shown in shades of red and brown. Bathymetric contour (100 m) added for depth reference.



area as figure 4 (Box B on map). Brighter areas indicate coarse-grained, rough, or hard seafloor; darker areas indicate unconsolidated (loosely packed) sediment. Interpreted substrate classes from figure 4 included for comparison. Bathymetric contour (100 m) added for depth reference.

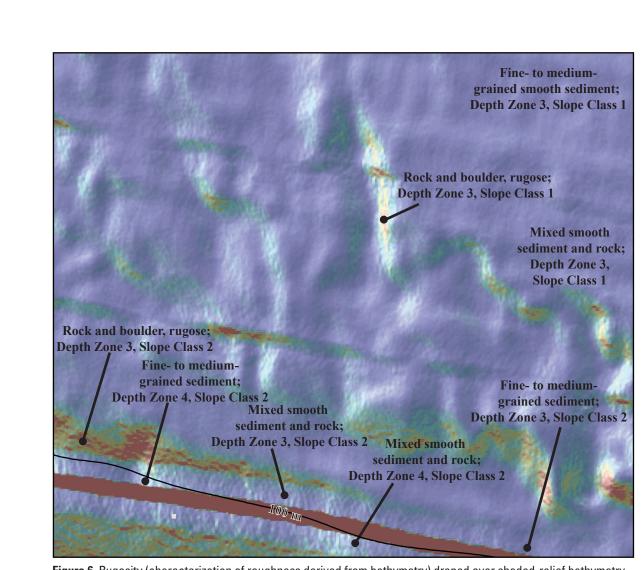


Figure 6. Rugosity (characterization of roughness derived from bathymetry) draped over shaded-relief bathymetry (see sheet 2) for same area as figure 4 (Box B on map). Rugosity values are displayed in muted "rainbow" color spectrum that ranges from purple (low rugosity) through green (medium rugosity) to red (high rugosity). Areas of high slope are indicated by high-rugosity values (red); areas of low slope, by medium- to low-rugosity values (green to purple); however, northwest-southwest-trending areas of high rugosity are data-collection artifacts. Interpreted substrate classes from figure 1 included for comparison. Bathymetric contour (100 m) added for depth reference.

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Seafloor Character, Offshore of Refugio Beach Map Area, California

BATHYMETRIC CONTOUR INTERVAL 10 METERS ONE MILE = 0.869 NAUTICAL MILES